

CHURCHMAN

EXPLANATION

OF

MAGNETIC

ATLAS.

PHILA.

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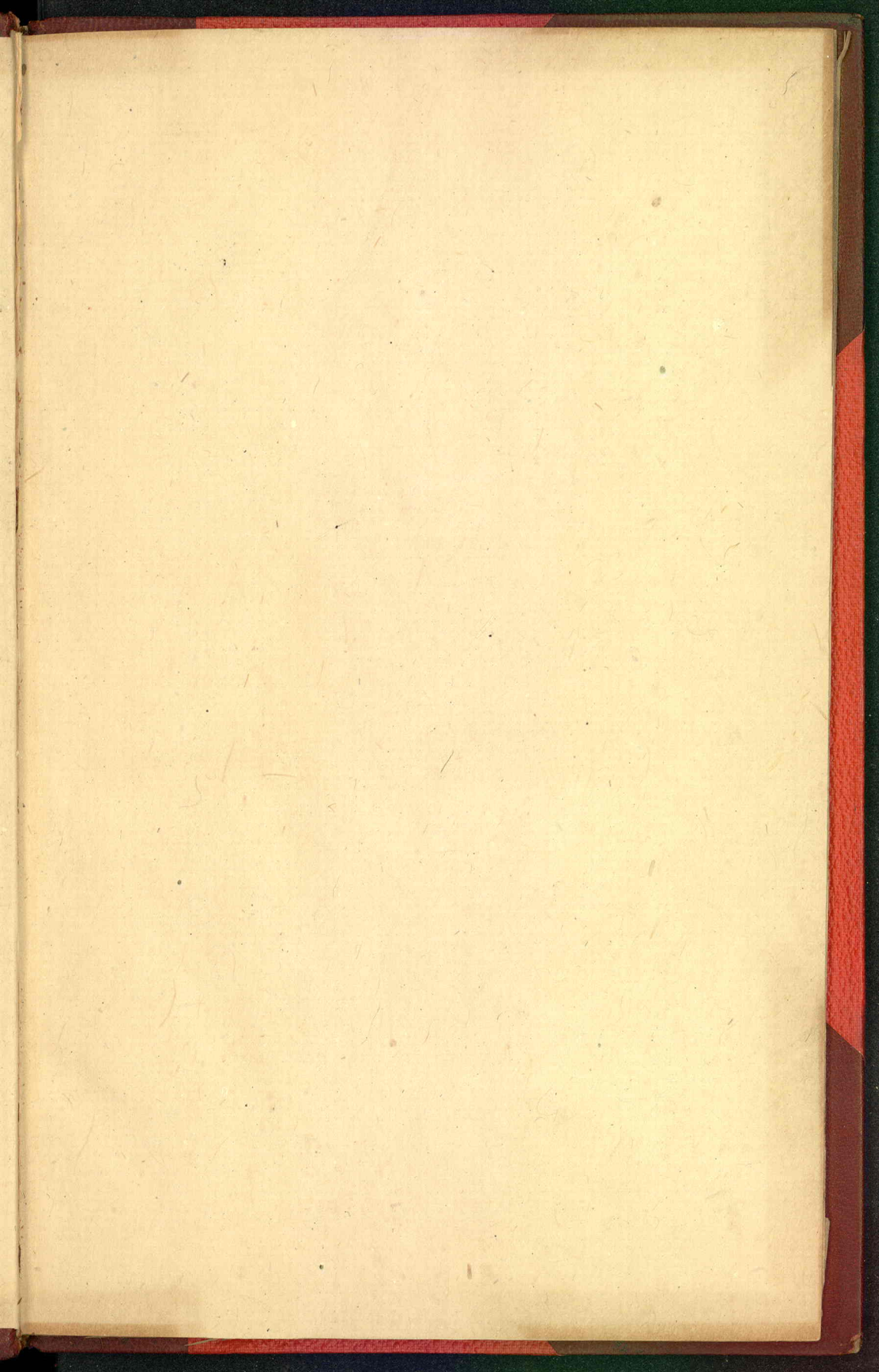
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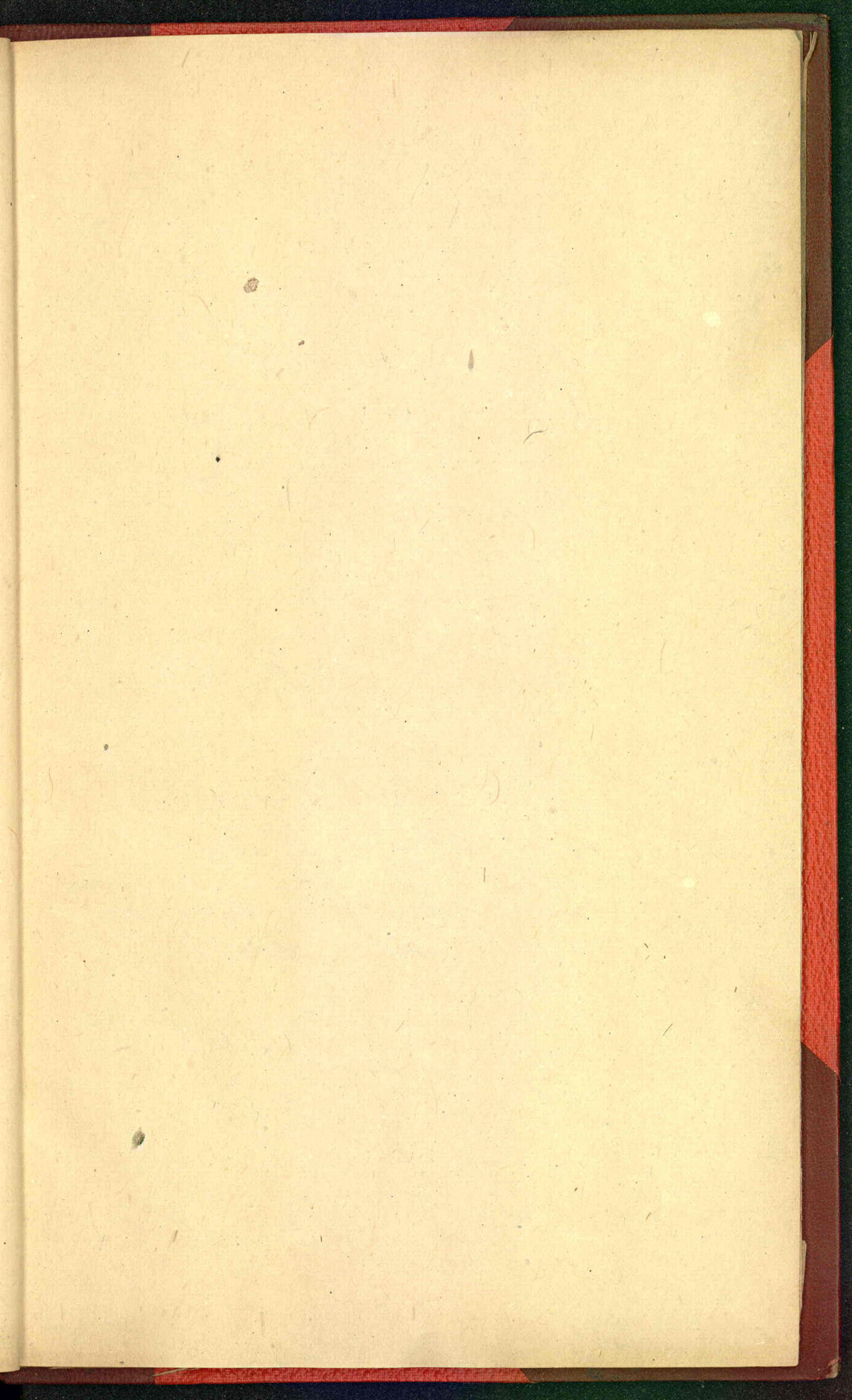
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13.
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AN
EXPLANATION
OF THE
MAGNETIC ATLAS,
OR
VARIATION CHART,

HEREUNTO ANNEXED;
PROJECTED ON A PLAN
ENTIRELY NEW,

BY WHICH THE MAGNETIC VARIATION ON ANY PART OF
THE GLOBE MAY BE PRECISELY DETERMINED, FOR ANY TIME,
PAST, PRESENT, OR FUTURE: AND THE VARIATION AND LATI-
TUDE BEING ACCURATELY KNOWN, THE LONGITUDE IS
OF CONSEQUENCE TRULY DETERMINED.

BY JOHN CHURCHMAN,

*Late land surveyor for the district of the counties of DELAWARE and CHESTER,
and for part of LANCASTER and BERKS, PENNSYLVANIA.*

PHILADELPHIA:
PRINTED BY JAMES & JOHNSON, ON THE NORTH
SIDE OF MARKET-STREET, BETWEEN THIRD
AND FOURTH-STREETS.
M, DCC, XC.

District of Pennsylvania, to wit.



BE it remembered, that on the seventeenth day of June, in the fourteenth year of the Independence of the United States of America, *John Churchman*, of the said district, hath deposited in this office, the title of a book, and the title or dedication of a chart, the right whereof he claims as Author, the title of the book being in the words following, *to wit.*

“ *An Explanation of the Magnetic Atlas, or Variation Chart, hereunto annexed; projected on a plan entirely new, by which the Magnetic Variation on any part of the globe may be precisely determined, for any time, past, present, or future: and the variation and latitude being accurately known, the longitude is of consequence truly determined: By John Churchman, late land-surveyor for the district of the counties of Delaware and Chester, and for part of Lancaster and Berks, Pennsylvania;*” and the title or dedication of the chart being in the words following, *to wit:*”

“ To *George Washington*, President of the United States of America, this *Magnetic Atlas, or Variation Chart*, is humbly inscribed by *John Churchman*:”—in conformity to the Act of the Congress of the United States, entitled, “ An act for the encouragement of learning, by securing the copies of maps, charts, and books, to the authors and proprietors of such copies, during the terms therein mentioned.”

SAMUEL CALDWELL,

Clerk of the District of

PENNSYLVANIA.



P R E F A C E.



IT appears probable that one of the principal causes, why more useful discoveries are not made, is the fear of ridicule, which is sometimes the fate of projectors who promulgate new opinions, and attempt new experiments. A desire of avoiding the sarcasms of ignorance and malevolence, may suppress many useful inventions; yet we find some gradually press forward; and although, for want of encouragement, an hundred probable schemes may sink in oblivion, there will ever be some of such magnitude, in the eyes of their own inventors, that, regardless of the "*world's dread laugh*," they will burst into day, and either go off in vapour, or remain permanent lights.

In a situation of speculative enquiry, I confess I had long continued; and in the beginning of the year 1787, I risked a declaration of my opinions before the public, apprehending I had formed a plan of much importance to navigation, confiding in their generosity to give it a candid reception, which in a great measure I was so fortunate as to obtain: and as the first principles seem at present to be universally admitted, I have the more reason to hope for further indulgence towards this little tract, which is designed

to accompany and explain the MAGNETIC ATLAS, or VARIATION CHART of all the Northern Hemisphere. If any imperfections should be found in either of them, the reader is respectfully solicited to supply the defect; and I trust, notwithstanding, under a conviction that they will do no *injury* to mankind, they may at least obtain for me their pardon, if not their thanks for my *intention* of rendering them a *service*. And yet, I must acknowledge, that, in pursuing this subject, I considered it also as an object of emolument, although in this respect I have done nothing more, than to accept the invitation held out by many Governments, with promises of a generous reward, to engage persons in the public service.

Having premised thus much, I shall, in the following treatise, proceed to describe, in a more particular manner, the elements of a system, which, I apprehend, attains to the actual and complete *Discovery of the LONGITUDE*.

This indeed is a subject which, hitherto, has generally excited a smile, whenever attempted; yet I have risked *that*, for the public good.

The variation of the compass, and its heretofore (imagined) uncertain laws, have long engaged the attention of philosophers. Why it should change, and become at one time *slow*, at another time *quick*, now *stationary*, and then *retrograde*, has puzzled the enquirer. These have long been subjects of observation; yet I have never heard that any regular system has hitherto been published, to account for or foretell, upon any rational plan, what will be the future move-

ments of this wonderful phenomenon, the magnetic influence. Whether my attempts to reconcile all these difficulties, and, of consequence, to build on them a certain system of longitude, will prove successful, or not, must be left to the world to judge.

The proposed problems may be solved by the magnetic atlas alone, without an accurate knowledge of the magnetic elements; but as the elements result from a multitude of observations, reflections, and deductions, and are the leading principles on which the chart is constructed, perhaps an explanation of them may not be unacceptable. They will appear in the first chapter, and will, no doubt, be found easy and intelligible, but more especially to all those who have in the least degree applied themselves to the study of spherical geometry, or the use of the globes.

As the introduction of a number of new terms appeared absolutely necessary, the liberty taken in this respect will be deemed pardonable.

Subscribers Names come to hand.

TITLES are considered as being of several kinds: 1st, Such as are merely epithetical; 2d, the usual names of office; 3d, appendages, &c. In a republican government, it is hoped that none in the following list will be offended at the omission of the former, especially as the personage to whom the Magnetic Atlas is addressed has generally no other title than that of President of the United States. Were there a conformity to custom, those distinguished characters would have the corresponding epithets prefixed. ‡ Right Reverend, † Reverend, § His Excellency, * Honourable: those marked || are members of the American Philosophical Society.

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C O N T E N T S.

CHAP. I.

Elements of Magnetism.

CHAP. II.

Solution of several Problems.

CHAP. III.

The Objection of false Variation removed.

CHAP. IV.

Concerning the Construction of the Magnetic Atlas.

CHAP. V.

On the Nature of the Magnetic Orbits and Magnetic Meridians.

CHAP. VI.

Concerning the Materials from which the Coasts were laid down.

CHAP. VII.

Concerning the Southern Hemisphere, the Magnetic Almanac, &c.

CHAP. VIII.

Hints concerning the Cause of the Magnetic Variation.

CHAP. IX.

The Method of proving the Revolutions of the two Magnetic Points.

CHAP. X.

On the Magnetic Tides.

Tables. Appendix.

CHAPTER I. OF THE NATURE AND EXTENT OF THE
CHAPTER II. OF THE CAUSES AND EFFECTS OF THE
CHAPTER III. OF THE HISTORY AND PROGRESS OF THE
CHAPTER IV. OF THE PRESENT STATE AND FUTURE PROSPECTS OF THE
CHAPTER V. OF THE INFLUENCE OF THE
CHAPTER VI. OF THE IMPORTANCE OF THE
CHAPTER VII. OF THE NATURE AND EXTENT OF THE
CHAPTER VIII. OF THE CAUSES AND EFFECTS OF THE
CHAPTER IX. OF THE HISTORY AND PROGRESS OF THE
CHAPTER X. OF THE PRESENT STATE AND FUTURE PROSPECTS OF THE

AN
EXPLANATION
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CHAP. I.

Elements of Magnetism.

Proposition I. **F**ROM a multitude of observations on the Magnetic Variation, in different parts of the world, at places whose situations have been well determined, it is found, that the magnetic horizontal needle hath an universal direction towards two points on the surface of the globe, at certain distances, one from the north, the other from the south Pole of the earth.

Definition I. One of the points towards which the magnetic needle hath a direction, being in the northern hemisphere (for distinction) may be called the *northern magnetic point*.

Def. II. As the other magnetic point is at a certain distance from the south pole of the

earth, it may be termed the *southern magnetic point*.

Note. The northern magnetic point on the chart is distinguished by Z.

Prop. II. *The northern magnetic point, in the beginning of the year 1777, was in about the latitude of $76^{\circ} 4'$ north, and longitude $90^{\circ} 58'$ west, from Greenwich.*

Prop. III. *The situation of the southern magnetic point, in the year 1777, I calculated to have been in even numbers in 72° south latitude, and 140° east longitude from Greenwich.*

Postulate. As on a plain a circle can be drawn through any three points, not in a direct line; so, on the surface of a globe, a circle or curve may be drawn through any three points whatever.

Prop. IV. *A circle drawn through three points on the surface of a globe, if the plane of the said circle passes through the centre of the globe, will be a great circle.*

Prop. V. *If through three points on the surface of a globe a circle be drawn, whose plane passes not through the centre of the earth; it will be a lesser circle.*

Def. III. A magnetic meridian is a curve drawn from one magnetic point to the other, through any given part of the globe.

Def. IV. A meridian of the earth is here understood to be a semicircle, although this term is also sometimes applied to a great circle.

Def. V. The angle between a meridian of the earth, and the magnetic meridian, is the variation of the compass.

Prop. VI. Although the length of the mean time taken by the sun from its departure from, until its return again to any one meridian of the earth, is well known to be just twenty-four hours, yet the mean time of the rotation of the earth on its axis from west to east is determined and known to be $23^{\text{h}} 56' 4''$.

Prop. VII. The two magnetic points have a perpetual motion, and also perform revolutions round the two poles of the earth, from west to east, as pointed out in the tables of their different situations; the northern one quicker, and the southern slower than the earth.

Def. VI. The time in which either magnetic point revolves round the pole of the earth, from a conjunction with any fixed star, until its return to the same again, may be termed its *sideral revolution*.

Def. VII. The time which either magnetic point requires from its leaving any one meridian of the earth, until its return to the same again, may be termed its *periodical revolution*.

Prop. VIII. The *sideral revolution* of the northern magnetic point is $23^{\text{h}} 55' 55'' 48''' 50''''$, and its *periodical revolution* $426^{\text{y}} 77^{\text{d}} 9^{\text{h}}$.

Prop. IX. The *sideral revolution* of the southern magnetic point is $23^{\text{h}} 56' 4'' 8'''$, and its *periodical revolution* 545 $\frac{1}{2}$ years, or thereabouts.

Prop. X. The two magnetic points are sometimes on the same meridian of the earth; sometimes on opposite meridians, and sometimes on neither.

Prop. XI. Whenever the two magnetic points are either on the same or on opposite meridians of the earth, then those meridians and the line of no-variation coincide with each other.

Note. By the tables we find that in the year 1832 the southern magnetic point will be $136^{\circ} 22'$ east from Greenwich, and in the year 1833 the northern magnetic point will be $43^{\circ} 40'$ west from the same meridian, the sum of these numbers is $180^{\circ} 2'$. Therefore, as any two opposite meridians are always 180° asunder, the two magnetic points about this time will be on opposite meridians. Then will the line of no variation be a meridian of the earth, when the calculation will be much more simple

Def. VIII. The line of no-variation is a line drawn through the different parts of the globe where the magnetic needle points due north.

Note. The line of no-variation is distinguished on the magnetic atlas by a broken curve line, one part of which is now to the westward of Philadelphia.

Prop. XII. The line of no-variation changes its place, as the two magnetic points change their places.

Prop. XIII. The line of no-variation alters its curvature, in proportion to the different positions of the two magnetic points.

Prop. XIV. *Whenever the two magnetic points are neither on the same nor on opposite meridians of the earth, then those parts, where some of the magnetic meridians coincide with other parts of different meridians of the earth, will be the line of no-variation.*

Axiom. If the two magnetic points were at equal distances from the two poles of the earth, and on opposite meridians, they would be diametrically opposite to each other.

Prop. XV. *If the two magnetic points were diametrically opposite to each other, all the magnetic meridians would be semi-circles.*

Prop. XVI. *As the two magnetic points are neither at equal distances from the two poles of the earth, nor at present on opposite meridians, they are not diametrically opposite to each other: And,*

Prop. XVII. *As the two magnetic points are not diametrically opposite to each other, none of the magnetic meridians, except two, are arches of great circles.*

Def. IX. A circle drawn every way equally distant from and between the two magnetic poles, magnetic points, or magnetic nadirs, will be the magnetic equator.

Note. The magnetic equator is distinguished in the chart by a line passing through the Indian Ocean, between the Islands of Ceylon and Sumatria.

Def. X. A point diametrically opposite the
C

southern magnetic point, may be termed the *northern magnetic nadir*.

Note. The northern magnetic nadir on the chart is distinguished by the letter W.

Def. XI. A point diametrically opposite the northern magnetic point, may be termed the *southern magnetic nadir*.

Prop. XVIII. *Although the plane of the only two magnetic meridians, which are arches of great circles, is continually changing, yet the magnetic points, the magnetic poles, and magnetic nadirs, are always in the plane of the same.*

Prop. XIX. *The magnetic equator divides the globe into two equal parts.*

Axiom. I. Every circle dividing the globe into two equal parts, is a great circle.

Axiom II. Every great circle has two poles.

Axiom III. The two poles of every great circle are diametrically opposite to each other.

Corollary. *Hence the two magnetic poles being distinct from the two magnetic points, which influence the direction of the needle, are nothing more than the poles of the magnetic equator.*

Note. The northern magnetic pole is distinguished in the chart by the letter X.

Def. XII. A right line drawn from one magnetic point to the other, may be called the *magnetic pointer-axis*.

Def. XIII. A right line drawn from one magnetic pole to the other, may be termed the *magnetic polar-axis*.

Def. XIV. A right line drawn from one magnetic nadir to the other, may be called the *magnetic nadir-axis*.

Prop. XX. The magnetic polar-axis, and no other, passes through the center of the earth.

Prop. XXI. The magnetic polar-axis is equally distant from and between the magnetic pointer-axis and magnetic nadir-axis, all of which are parallel to each other.

Prop. XXII. As the two magnetic points are not diametrically opposite to each other, the distance between the magnetic points and the magnetic equator, is different on different sides of the globe; but,

Prop. XXIII. The distance between the magnetic poles and the magnetic equator is always equal on every side of the globe.

Prop. XXIV. As the two magnetic points move with unequal velocities, the distance between the magnetic pole and the magnetic point undergoes a continual alteration.

Prop. XXV. As the distance between the magnetic points and the magnetic poles increase, so all the magnetic meridians which are not arches of great circles decrease.

Def. XV. As the magnetic equator divides the globe into two equal parts, for distinction, one

half may be called the northern, and the other the southern magnetic hemisphere.

Prop. XXVI. *In each magnetic hemisphere, the magnetic pole is at any given time equally distant from the magnetic point and the magnetic nadir.*

Def. XVI. *Those two points at the intersection of the magnetic equator, and the equator of the earth, may be termed the magnetic equinoctial points.*

Prop. XXVII. *The two magnetic equinoctial points are diametrically opposite to each other.*

Prop. XXVIII. *The distance between the magnetic pole and the pole of the earth, in either hemisphere, is equal to the angle at either magnetic equinoctial point formed by the magnetic equator and the equator of the earth.*

Prop. XXIX. *Whenever the line of no-variation is the same with a meridian of the earth, if bisected by the magnetic pointer-axis, it also represents the only two magnetic meridians, which are arches of great circles.*

Def. XVII. *The dipping-needle is a magnetic needle suspended on a pin, passing through its centre in a horizontal direction.*

Axiom. *Magnetic powers of equal force have equal influence, at equal distances.*

Corol. I. *As the magnetic equator is equally distant from each magnetic point, if the dipping-needle*

stood horizontal on the magnetic equator, the influence of each magnetic point would be equal.

Corol. II. If the influence of each magnetic point were equal, the magnetic meridians would be all circular curves.

Corol. III. If the magnetic meridians were all circular curves, they might be considered as parts of regular polygons of an infinite number of sides, and the horizontal magnetic needle would always represent one of those sides.

Corol. IV. If those magnetic meridians which are not arches of great circles, be circular curves or not, the horizontal magnetic needle will make always a tangent to the magnetic meridian.

Prop. XXX. In the northern magnetic hemisphere the dipping-needle gives the north dip, and in the southern the south dip, proportionally to the distance from the place where it stands horizontal.

Prop. XXXI. The magnetic equator, as well as those two magnetic meridians, which are arches of great circles, continually changes its place.

Def. XVIII. If on a globe a number of circles be drawn parallel to the magnetic equator, they may be termed parallels of magnetic Latitude.

Prop. XXXII. If any one magnetic meridian be calculated as a great circle, which is not such, the difference of the angle of magnetic variation between the calculation and actual observation will be proportioned to the magnetic latitude.

Prop. XXXIII. *If, in the same parallel of magnetic latitude, any number of magnetic meridians be calculated as great circles, which are not such, the difference of magnetic variation between the calculation and observation will be proportioned to the number of degrees on the magnetic equator, computed from its intersection with one of the two magnetic meridians, which are arches of great circles.*

Def. XIX. Spherical Trigonometry is that science which teaches how to calculate the parts of triangles formed on the surface of a sphere, by three arches of great circles.

Note. The lesser circles of the sphere, by different authors on this subject, have heretofore been declared not to fall under trigonometrical calculation, not only because they are of different magnitudes, or that they have not the same radius as the great circles; but also, because their planes do not necessarily cut one and the same axis, nor pass through the centre of the sphere.

Corol. *Hence as, by the present method, lesser circles of the sphere are calculated, as well as great circles, a new branch of science is obtained.*

CHAP. II.

Solution of several Problems.

PROBLEM I.

Given, the situation of the place.

Required, the variation of the compass for any time past, present, or future.

FIND first the place of both the magnetic points, by the tables; secondly, draw a curve from one magnetic point to the other, through the given place; this curve will be the magnetic meridian, and the contained angle between the magnetic meridian, thus drawn, and the meridian of the earth at the given place, is the variation of the compass for that time.

EXAMPLE.

For the time to which the chart is fitted, it is required to know the variation of the compass in latitude $44^{\circ} 30'$ north, and longitude 170° east from Greenwich.

First find where this meridian and parallel of latitude meet on the chart, then trace those two meridians slightly with a pencil, from the intersection, the length of the radius of the circle from which the line of chords is constructed, that they may be better distinguished.

Secondly, measure the angle between the meridian of the earth and the magnetic meridian, or between the black line and dotted line, which is the same thing, which angle is 20 degrees: and

as the dotted line runs here to the eastward of the black line, the variation is consequently 20 degrees east.

Note. Efface with a rubber the mark made by the pencil, that the chart may not be injured.

P R O L L E M II.

Given, the variation of the compass, and latitude.

Required, the longitude.

Find what is the angle of variation at the intersection of the desired meridian and parallel of latitude, and when the observation of the variation is equal to the variation on the chart, the ship must be in the longitude required.

E X A M P L E I.

A ship sailing in the latitude of 50° north, on a voyage from Philadelphia to London, it is required to know when she is within twenty degrees of the meridian of Greenwich. In measuring the angle on the chart between the twentieth meridian from Greenwich and the magnetic meridian, in the latitude of 50° north, it is found to be $22^{\circ} 20'$ west: so that when the accurate observer finds $22^{\circ} 20'$ west variation in the latitude of 50° north, he knows himself to be 20° west from the meridian of Greenwich.

E X A M P L E II.

A ship is bound from Philadelphia to Lisbon, and is sailing in the latitude of 40° north; it is

required to know when she is within 15 degrees of the meridian of Greenwich: the angle between the black and dotted lines is measured at the intersection of the fortieth degree of latitude, and the fifteenth meridian from Greenwich; this angle is found to be $19^{\circ} 10'$; therefore, when the variation is $19^{\circ} 10'$ west in the latitude of 40° north, the observer must consequently be within fifteen degrees of the meridian of Greenwich; and as Lisbon is $8^{\circ} 52'$ west from Greenwich, if this is subtracted from 15° , it gives $6^{\circ} 8'$ for the longitude of the place of observation west from Lisbon.

P R O B L E M I I I .

To find the situation of those two magnetic meridians, which alone are arches of great circles for any given time :

Find first the place of the magnetic points by the tables, for the time required; secondly, find either of the two magnetic nadirs which are opposite to the two magnetic points; thirdly, draw a circle through these three points, and this will always be a great circle: fourthly, bisect this great circle with the magnetic axis, which is a right line passing from one magnetic point to the other, and these two parts will represent those only two magnetic meridians which are arches of great circles for any given time.

E X A M P L E .

For the beginning of the year 1794 (the time for which the chart is constructed) we find, by

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the tables, that the northern magnetic point will be $76^{\circ} 37' 17''$ west from Greenwich, and that in the year 1792 the southern magnetic point will be 139° east from the same meridian: as the southern magnetic point alters its place by flow degrees, two years will make but a small difference. Then seeing it is self-evident that two opposite meridians are always 180° apart, because 139° added to 41° are equal to 180° , the northern magnetic nadir must be 41° west from Greenwich, and the same distance from the equator as the southern magnetic point; therefore, a circle drawn through the northern magnetic point Z, the northern magnetic nadir W, and the southern magnetic point, will be a great circle; and if this circle is bisected by the magnetic axis, these two parts will be the only two magnetic meridians which are to be arches of great circles for that time.

P R O B L E M I V .

To find the situation of the magnetic equator for any given time :

Find first the situation of those two magnetic meridians which are arches of great circles for the time required, by the last problem; secondly, find a point in one of those magnetic meridians which are arches of great circles, half way between the magnetic point and magnetic nadir; this will be the magnetic pole: thirdly, draw a circle every way 90° distant from the magnetic pole, which will be a great circle, and will be the magnetic equator.

EXAMPLE.

The northern magnetic pole is distinguished on the chart by the letter X; and if a great circle is drawn every way 90° distant from X, it will pass between the islands of Ceylon and Sumatra, and will be the magnetic equator for that time, as will appear by the name thereof on the chart.



CHAP. III.

The Objection of false Variation removed.

IF occasion should require, it will be very easy to compare the Magnetic Atlas with Captain Cooke's observations; and although the agreement may not be exact, this will be accounted for, from several causes: First, the variation of the compass at the same place being subject to change, the length of time between Cooke's last observations, and the time for which the Magnetic Atlas is constructed, will cause a considerable difference: Secondly, notwithstanding Captain Cooke, and the officers who bore him company, were possessed of very great abilities in the line of their profession,—perhaps, neither the variation of the needle, nor the situation of the place where it was observed, was at all times truly determined. The principal cause of false variation has been, with great reason, attributed to the influence which the *iron* on board the ship has over the magnetic needle: it was, therefore, natural to consider, how this main objection

might be overcome. The following method has been found, by actual observation and experiment, to have the desired effect :

It is nothing more than fixing a true meridian on the shore, out of the reach of the attraction of iron : here the variation is taken by different compasses on this meridian ; and if they are all true, they give the same variation at the same time and place ; then, before the ship sails, the variation is taken on board, having the ship turned, if occasion should require, on every point of the compass ; and, by noting the difference between the true variation on the true meridian, and the false variation on board, a table of difference may be constructed, which perhaps will always give the allowance necessary to be made for false variation, throughout any voyage.

It is well known, that on land there is no difficulty in determining the longitude by Jupiter's satellites : if the true situation of any coast, and the situation of the magnetic points for any given time, are known, it is easy to find the true variation by calculation ; so that if bodies of iron ore upon the sea shore should even influence the needle, the difference between the variation by calculation and observation will consequently be the allowance for false variation : By this method the variation may be very easily corrected, with a little care.

Sometimes the variation by amplitude has been different from that by azimuth : this difficulty appears to be removed in a very satisfactory man-

ner in Profeffor Van Swinden's letter, published in the appendix, to which I muſt beg leave to refer.



CHAP. IV.

Concerning the Conſtruction of the Magnetic Atlas.

THE main object in view, has been, to prove the principles of the plan; and, as moſt of the places from which the proofs are drawn, are computed from the meridian of Greenwich, I have alſo called this the firſt meridian; ſuppoſing, the obſervations could be compared with leſs trouble on the preſent chart, which is conſtructed in ſuch a manner, that, if the blank gores were cut out, the remainder would fit and cover half a globe, forty-eight inches in circumference. Theſe blank ſpaces, as they become very narrow in the latitude of ſixty, were made to terminate in that degree; whereas, if they had been continued to the pole of the earth, the chart would, conſequently, have been more correct.

Moreover, this method of projecting the ſphere with the magnetic meridians, will perhaps, upon inſpection, be found to ſhew the proportions of each country, as well as the nature of the curves formed by the magnetic meridians, better than upon Mercator's projection, on which the Hallean lines are delineated. As the preſent projection may ſerve not only for a chart, but for covering globes, if occaſion ſhould require.

CHAP. V.

On the Nature of the Magnetic Orbits and Magnetic Meridians.

BY the tables of the places of the two magnetic points, they are represented to have an equable and uniform motion; the orbits are likewise described on the chart to be circular; but, as the antient magnetic observations seldom appear so correct as could be desired,---if future experience should prove them to be in any degree elliptical, the progress of the magnetic points, therein, will probably be precisely conformable thereto. All the earth's meridians are distinguished by black lines, and the magnetic meridians by dotted lines. The magnetic meridians are all projected as circular curves, although, as demonstrated in the magnetic elements, none except two are arches of great circles. If future experience should even prove that the influence of one magnetic point should be greater than that of the other, which seems in some degree to be the case, as this proportion will be better established by a little more experience, there appears not the least doubt but they will always be included within the most rigid rules of calculation: had the encouragement been sufficient, it would have been highly necessary that the scale on which the work was laid should have been considerably larger in proportion to the radius of the circle, on which the line of chords is constructed; for if the radius of this circle had been shorter than is delineated on the corner of the magnetic atlas, there would have been an

inconveniency; as the odd minutes of magnetic variation could not have been measured with so much exactness: therefore I have constructed the lines of chords, sines, tangents, &c. by a circle, whose radius is two inches, being the same length as those on Gunter's scale. But if any causes should occasion, on the chart, the angle at the place of observation between the magnetic meridian and the meridian of the earth to measure more or less to the northward than the southward, a mean is recommended to be taken for the true variation.



CHAP. VI.

Concerning the Materials from which the Coasts were laid down.

IT is generally allowed, that the greatest danger in navigation, is near the coast of a country: On this account, every coast should be laid down with the greatest care. I hold myself under many obligations, for the assistance which I have had from the works of many of the most able geographers and modern circumnavigators, whose labours have been of infinite service in this undertaking; as well on the coasts of the old world, as of the new discoveries: but, as they have also been obliged, in many instances, to depend on the observations of their predecessors,---I hope not to be blamed on this account; as this indulgence is universally allowable. The Magnetic Atlas may therefore be said to be composed, not only from my own knowledge in

America, but also from a collection of many works of the best authority, and from the most accurate astronomical observations: yet, if any errors should be incorporated therein, they will be best rectified by future experience.



CHAP. VII,

Concerning the Southern Hemisphere, the Magnetic Almanac, &c.

IT appears to be a matter of the most consequence, to publish, first, the Northern Hemisphere, as it is navigated much more than the southern; and the truth and utility of this chart will the sooner be brought to the test. However, I have also in hand a chart of the Southern Hemisphere, on the same projection; which will be applied to use with much more exactness, than the present,---seeing the southern magnetic point is much nigher to the equator of the earth than the northern magnetic point; and consequently, the variation of the compass alters more in the southern hemisphere, in proportion to the distance run.

But if the smallness of the scale, or any combination of causes, should conspire to render these charts in any degree imperfect; these objections will probably be all overcome, in another new work, to be entitled, THE MAGNETIC ALMANAC, containing an universal set of tables, shewing what latitude and variation correspond with any part of any meridian; and made easy to the

most common capacity, without the trouble of measuring angles: This work has been some time preparing for the press; and will be the result of tens of thousands of calculations.



CHAP. VIII.

Hints concerning the Cause of the Magnetic Variation.

FINDING it now universally admitted, that two magnetic points, not diametrically opposite to each other, are sufficient to account for the variation in all the different parts of the earth, and to correspond with observation; there must, necessarily, be a cause for the needle having an universal direction towards these two magnetic points; and this cause must either be below the surface of the earth, or above the same. The celebrated Doctor Halley supposed the cause to be below the surface, and communicated by the earth:---but the northern magnetic point is found to move faster than the earth, from west to east, as will appear by the tables. And, as it is an axiom long established, that "No cause can give what it has not itself,"---it is left to the judgment of others, whether, or not, the earth can give a swifter motion, than it has itself, to a nucleus therein contained. With a view to experiments, I have made several trials to embark on a voyage to that part of Baffin's Bay, where the north point of the needle is attracted: hoping that some observations might be made, as well

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to determine how nearly the variation could be ascertained, as to throw some light on this mysterious principle, in the expectation, that they might probably pave the way to other discoveries: and apprehending, likewise, there would be no difficulty in sailing to the northern magnetic point; because navigators have frequently sailed near five degrees further north, although on another side of the globe. I have also been induced to contemplate such an undertaking at this time, because this year began with very moderate weather, which continued for the most part, so very mild, that it is thought, by some accurate observers, to have been the most moderate winter during the memory of man; and therefore it was natural to conclude, firstly, that there was less ice made this winter, than commonly; secondly, that the less ice there is made in winter, the sooner it would melt in the spring; thirdly, that the sooner the ice should dissolve in the spring, the longer would be the ensuing summer in the northern regions.

These several conclusions caused me to strain every nerve, to perform the proposed voyage: but, as the publication of the present chart had been promised a considerable time, it was thought it could not, with propriety, be delayed any longer. The desire of making use of this favourable time to go abroad caused the work to be too much hurried: so that whatever may be the faults in the execution, it is hoped the many respectable subscribers, and others, will bestow upon it their usual candour, and give it a favourable reception; without suppo-

ing that the principles will be affected thereby. Hoping, on my part, that these labours will eventually prove useful to mankind; and, by lessening the dangers of the sea, that those brave and useful citizens who are employed on the watery element, may be secured from at least a *part* of the numerous casualties and distresses to which they are daily exposed in navigating the trackless ocean; and that I may thus become an humble instrument, in the hands of Providence, to prolong the lives of many of my fellow-men.



CHAP. IX.

The Method of proving the Revolutions of the two Magnetic Points.

IT may, perhaps, not be improper to add something concerning the manner in which the periods of the revolutions of the two magnetic points are proved: for this purpose, recourse has been had to actual observations of the magnetic variation, made at different times, in both hemispheres, at several places, the situations of which have probably been well determined.

1stly, In the beginning of the present year, 1790, the longitude of the northern magnetic point, as appears by the tables, is calculated to be 80° west; the southern magnetic point, in 1787, is found to be $139^{\circ} 20'$ east; and the city of Philadelphia being in latitude $39^{\circ} 56' 55''$ north, and longitude $75^{\circ} 13' 30''$ west, all computed

from Greenwich ; the variation of the compass here is $1^{\circ} 57'$ west ; a magnetic meridian drawn from one magnetic point to the other, through the city of Philadelphia, makes an angle with this meridian of $1^{\circ} 57'$, which is found to agree with the real fact.

2dly, In the year 1657, by the tables, the northern magnetic point is placed in $167^{\circ} 39'$ east, and the southern one $147^{\circ} 54'$ east from the same meridian. This year, the magnetic needle at Greenwich, or London, pointed due north ; and as the magnetic needle is always a tangent to the curve formed by the magnetic meridian, if this curve is drawn for the year 1657, from one magnetic point to the other, through the city of London, the magnetic needle, at that time and place, will be a tangent to the curve ; then there will be no angle between the magnetic meridian, thus drawn, and the meridian of London.

3dly, In the year 1642, by the tables, the northern magnetic point was in $154^{\circ} 59'$ east, and the southern one in $148^{\circ} 54'$ east. In this year Tasman visited Van Diemen's Land, where it is reported by him, that the needle pointed due north. The situation of Adventure Bay, in Van Diemen's Land, being ascertained by Captain Cooke, in the year 1777, to be in $43^{\circ} 21'$ south latitude, and $147^{\circ} 25'$ east longitude : If a curve is drawn from one magnetic point to the other, through Adventure Bay, for the year 1642, this curve will coincide with the meridian of the earth at this bay, as was really the case, accor-

ding to Tafman's observation. This will, no doubt, be a satisfactory proof, to such who have leisure to try the experiments; but it may be supposed, by some, that as there was no variation this year at this place, the southern magnetic point must have been on the same meridian of the place where the magnetic needle points north: if the two magnetic points had been either on the same, or on opposite meridians, this must have been the case, according to the foregoing elements; but although they were within $6^{\circ} 5'$ of the same meridian, this difference is sufficient to cause the line of no-variation not to be a meridian of the earth. A mistake of this sort I at first fell into; for on reading that there was no variation at London in the year 1657, I concluded that the northern magnetic point was just 180° from that place, without sufficiently considering, that the southern magnetic point was then neither on the same nor on opposite meridians; which caused an error in the revolution of the northern magnetic point, which now stands rectified in the present chapter: But if, by future observations, the period of either should be found not quite so exact as the length of a year, this, it is hoped, will be pardonable, seeing the precise length of a year has not been long determined, notwithstanding the many volumes of astronomical observations during so many centuries. Thus, having sufficient data to prove nearly in what parts of their orbits the magnetic points were in former times, the next thing will be to try how near the periods will agree with the tables of the two magnetic points. I shall treat first of the periodical and sidereal re-

volution of the northern one. In the beginning of this present year, 1790, we find, by calculation, that the northern magnetic point is 80° west; and in 1657 it was $167^{\circ} 39'$ east from Greenwich, we have $80^{\circ} + 167^{\circ} 39' = 247^{\circ} 39'$; then if we take the number of degrees round the earth $360^{\circ} - 247^{\circ} 39' = 112^{\circ} 21'$. Also *Anno Dom.* $1790 - 1657 = 133$ years; then as $112^{\circ} 21' : 360^{\circ} :: 133^y : 426^y 77^d 9^h 54'$. Then for the sidereal revolution of the northern magnetic point, As $426^y 77^d 9^h 54'$: $360^{\circ} :: 23^h 56' 4'' : 8^h 18^m 9^s$ then we take the length of a sidereal day, $23^h 56' 4'' - 8^h 18^m 9^s = 23^h 55' 55'' 41^m 51^s$; this will be the sidereal revolution required.

Secondly, for the periodical and sidereal revolutions of the southern magnetic point It is found, by calculation, from the observations of Capt. Cooke, in the southern hemisphere, in the year 1777, that the southern magnetic point was in even numbers 140° east longitude from Greenwich; and by Tasman's observation, in the year 1642, a like calculation is made, by which the southern magnetic point is found to be in about $148^{\circ} 54' 9'' 27'''$ east, then we have $148^{\circ} 54' 9'' 27''' - 140^{\circ} = 8^{\circ} 54' 9'' 27'''$. Likewise $1777 - 1642 = 135$ years; then as $8^{\circ} 54' 9'' 27''' : 360^{\circ} :: 135^y : 5459$ years for the periodical revolution of the southern magnetic point. And for the sidereal revolution of the southern magnetic point, we have the following proportion, viz. As $5459^y = 172,269,335,460^d : 360^{\circ} = 77,760,000^m :: 23^h 56' 4'' = 86164^m : 38^m + 23^h 56' 4'' = 23^h 56' 4'' 38^m$ for the sidereal revolution of the southern magnetic point.

On the Magnetic Tides.

BESIDES the ever memorable deluges of Noah, Ogyges, and Deucalion, we have innumerable other accounts of the waters of the ocean making less remarkable encroachments on the shores at particular times and places, and returning to their former bounds. If it were necessary, a multitude of instances might be produced; though, were I only to hint at one twentieth part of those which might be enumerated, they would far exceed the proposed bounds of the present work. Among the writings of the antient Romans, some accounts of this sort stand recorded in Ovid's *Metamorphoses*,

- “ *I’ve seen the solid earth transform’d to sea,*
 “ *And water also turn to solid land,*
 “ *Fishes’ shells lie distant from the ocean,*
 “ *And rusty anchors on the tops of mountains!*

And Horace sings, that

- “ *Fishes swim in bushy groves,*
 “ *Once the well known perch of doves.*

The author of the *History of the Earth and Animated Nature* gives many instances confirming the same opinion, and adds, that the seas being thus seen to give and take away lands at pleasure, is, without question, one of the most extraordinary considerations in all natural history. In some places, he says, it is seen to obtain the superiority by slow and certain approaches; or to burst in at once, and overwhelm all things

in undistinguished destruction; in other places it departs from its shores, and where its waters have been known to rage, it leaves fields which soon become covered with the most beautiful verdure; and in another place, "that all this is wonderful; and perhaps, instead of attempting to enquire after the cause, which has hitherto been inscrutable, it will best become us to rest satisfied with admiration." I have taken some pains in making a collection of all the accounts of this sort within my reach, and find that the low countries, the United Netherlands in particular, have often been overflowed: I shall at present select only three of the last which have happened in that champaign country. The first of the three was about the year of our Lord 570, when Turonens says, that even the people of part of France were almost swallowed up by inundations; that Italy also suffered prodigiously, and the whole wall of Lyons was thrown down.

Secondly; Henry the first, of England, was born in the year 1068, and in his time there happened a mighty inundation, which extended to Flanders; whereby a great part of that country was irrecoverably lost, and many of the poor distressed people, being bereft of their habitations, came over to England; King Henry, taking compassion of their distressed condition, and also considering that they might be beneficial to his subjects, by instructing them in manufactures, he first settled them about Carlisle, and afterwards removed them into South Wales, where many of their posterity are reported by the celebrated Ray to be remaining in his time.

About this time also, a large estate, or island, the patrimony of Earl Goodwin, containing about 4000 acres, was overflowed by the ocean, and was afterwards called the Goodwin sands.

The last inundation of note which happened in Holland, was in the year 1446, when the sea gradually swelled, until it broke in at Dort, and drowned one hundred thousand persons, and a greater number about Dullart: two or three hundred villages are declared, by Ray, to have been laid under water, leaving the tops of steeples and towers visible when the tide was out.

If we only contemplate the time between these former inundations, and conceive that what has happened heretofore may also come about again, may not we then, in the approaching century, at the same place, expect the like event?

After collecting various accounts of inundations which have happened in different parts of the world, and in different ages, and after their arrangement in chronological order, there is found a very remarkable agreement between them and the periods of revolution of the magnetic points. Hence, from a variety of deductions, the following conclusions are drawn.

1st. That as the periodical revolution of the northern magnetic point is in even numbers, about 426 years, whenever this alone comes on the meridian of any place, the waters of the ocean gradually swell to such a degree, as to overflow all low flat lands near its borders, which may be termed a *magnetic tide*.

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2d. That as the periodical revolution of the southern magnetic point is about 5,429 years, when the two magnetic points are in conjunction, the ocean swells to such a degree, as gradually to cover the high grounds, which may be termed a *magnetic spring tide*.

3. That at the times of the deluge of Noah, of Ogyges, and Deucalion, the two magnetic points, from their rate of revolution, were both near the meridian of those places where they happened respectively, and never since.

According to the best accounts, Noah's deluge was 2349 years before the birth of Christ, and Deucalion's deluge 1500 years before the same period. Then $2349 - 1500 = 849 - 426 = 423$; and as the period of the northern magnetic point is about 426, these two deluges make within three years of two revolutions of the northern magnetic point. But the famous deluge of Ogyges happened between that of Noah and Deucalion. Ogyges was King of the Thebans, or, as some say, of Ogygia and Aëte, afterwards Boeotia and Attica; he is recorded to have been the first founder of Thebes and Eleusin: some affirm that he perished with all his subjects 1796 years before Christ. In Ray's *Physico Theological discourses*, the deluge of Ogyges is said to have laid waste the country where it happened, almost two hundred years. I therefore suspect the time commonly allowed for that event is the time in which the waters abated, otherwise there would have been so little time between the deluges of Ogyges and Deucalion as not to distin-

guish them apart. The northern magnetic point must have been near the meridian of Athens, in Greece, at the deluge of Noah, according to its rate of revolution. Athens is 24° east longitude from Greenwich, and the northern magnetic point in 1790 is 80° west from the same meridian. We have $80^{\circ} + 24^{\circ} = 104^{\circ}$; then round the earth is $360^{\circ} - 104^{\circ} = 256^{\circ}$; likewise $360^{\circ} \times 9$ revolutions $= 3240^{\circ} + 256^{\circ} = 3496^{\circ}$. Also Noah's deluge before Christ $2349 + 1790 = 4139$; then as $4139^{\circ} : 3496^{\circ} :: 1^{\circ} : 50' 40'' 44'''$ for its annual rate, which is found to agree with the tables to a minute.

Then, in order to try the agreement of the southern magnetic point, according to its rate of revolution it must have been, at the beginning of the deluge of Ogyges, near the meridian of Athens, 24° east longitude from Greenwich, and in 1777 it was 140° east by calculation and the tables; We have $140 - 24 = 116$, and the degrees round the globe $360^{\circ} - 116^{\circ} = 244^{\circ}$ for the number run since the deluge of Ogyges. Then from the beginning of this deluge, before Christ, $1923^{\circ} + 1777 = 3700$ years; then as $244^{\circ} : 3700^{\circ} :: 360^{\circ} : 5459$ years, which agrees exactly with the tables and calculation in the last chapter, and I hope none will imagine an inconsistency with the dignity of the Deity, in acting by secondary causes in this case, as well as many others.

Diodorus Siculus, in his fifth book, gives an antient story, current among the Samothracians, that before any other floods recorded in history,

there was a very great deluge that overflowed a good part of the coast of Asia, and the lower grounds of its islands, when the Euxine sea first broke open the Thracian Bosphorus and Hellespont, and drowned all the adjacent countries.

Many of the moderns seem to think that the account of the great island of Atlantis, mentioned by the antients, is not altogether fabulous, and that America agrees to the description thereof; it is reported to have sunk under water, at a time answerable to the two magnetic points being in conjunction on this side of the world. The most distinct account of this extensive country is mentioned in the *Timæus* of Plato, according to the following abridgement. The Atlantis was a large island in the Western Ocean, situated before or opposite to the Straits of Gades (or Cadiz, near Gibraltar.) Out of this island there was an easy passage into some others, which lay near a large continent exceeding in greatness all Europe and Asia. Neptune settled in this island, (from whose son Atlas its name was derived) and divided it among his ten sons. To the youngest fell the extremity of the island called Gadir, which, in the language of the country, signifies fertile, or abundant in sheep. At length, the island sunk under water, and for a long time afterwards the sea thereabouts was full of rocks and shelves.

As the isthmus of Darien is so very narrow, perhaps South America itself was the island of Atlantis, and North-America nothing less than

that great continent described by Plato. It is true that petrified sea shells are often found in layers on high ground, and the natives of this country have a tradition of its being overflowed. Lewis Evans, in a note in his first map of the American colonies, declares, we have glaring marks of a deluge in America of a more recent date than those of the old world. Nay, Thomas Jefferson, Esq; the Secretary of State, in his notes on Virginia, and Charles Thomson, Esq; late Secretary of Congress, in an appendix thereto, both give us very pertinent and entertaining remarks on this subject. General Lincoln, likewise, in a letter to the President of the University of Cambridge, in Massachusetts, which is published in the Memoirs of the American Academy of Arts, makes some ingenious observations pointing the same way. To these several valuable works I must beg leave to refer.

Since the Settlement of North-America, by Europeans, it is manifest that the sea has made considerable encroachments on the land; on the eastern coast of this country a multitude of evidences are visible, which agree with this hypothesis; as in Nova-Scotia the stumps of trees are seen twenty feet below the common high water mark. On the banks of Delaware river, lives a poor old illiterate man, who has distinguished the highest tide which has happened every year for many years, by a notch on a tree near the shore; he has continued his observations, until his marks have mounted one above another in a surprising manner; and some men are still living in Dela-

ware State, who have reaped wheat on grounds which are now converted to salt marsh. On Chesapeak Bay, when the lands were first surveyed, some of them were bounded by marked trees, which then stood on dry ground, and now their stumps stand under water; also, in some places, where orchards were planted near the shore, the waters have encroached to such a degree as to kill the fruit trees: at one place a burying-ground is now part dashed by the waves, which was once at a distance from the shore. In Capt. Bernard Romans's Natural History of Florida, vol. I. page 20, he describes a number of stumps which are only to be seen at low water: he believes them to be the ruins of ancient forests, on which the sea has made an encroachment.

A Table

OF THE PLACE OF THE NORTHERN MAGNETIC POINT,

For the beginning of each Year, from the time of its leaving the Meridian of Greenwich the last time (which was in the Year 1459) until its return to the same Meridian again, which will be in the Year 1884, including one full period, or 426 Years, 77 Days, 9 hours, or thereabouts, moving at the rate of $50^{\circ} 40' 44''$ of Longitude in a Year.

| Alter Chant | East. | Alter Chant | East. | Alter Chant | East. | Alter Chant | East. | Alter Chant | West. | Alter Chant | West. | Alter Chant | West. | Alter Chant | West. |
|----------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|
| o | i | ii | iii | iv | v | vi | vii | viii | ix | x | xi | xii | xiii | xiv | xv |
| 1459 | 0 | 23 | 1 | 716 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1460 | 1 | 1 | 58 | 00 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1461 | 2 | 0 | 4 | 38 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1462 | 3 | 1 | 7 | 19 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1463 | 4 | 2 | 10 | 30 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1464 | 5 | 3 | 13 | 41 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1465 | 6 | 4 | 16 | 52 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1466 | 7 | 5 | 19 | 03 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1467 | 8 | 6 | 22 | 14 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1468 | 9 | 7 | 25 | 25 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1469 | 10 | 8 | 28 | 36 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1470 | 11 | 9 | 31 | 47 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1471 | 12 | 10 | 34 | 58 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1472 | 13 | 11 | 37 | 09 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1473 | 14 | 12 | 40 | 20 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1474 | 15 | 13 | 43 | 31 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1475 | 16 | 14 | 46 | 42 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1476 | 17 | 15 | 49 | 53 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1477 | 18 | 16 | 52 | 04 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1478 | 19 | 17 | 55 | 15 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1479 | 20 | 18 | 58 | 26 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1480 | 21 | 19 | 61 | 37 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1481 | 22 | 20 | 64 | 48 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1482 | 23 | 21 | 67 | 59 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1483 | 24 | 22 | 70 | 10 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1484 | 25 | 23 | 73 | 21 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1485 | 26 | 24 | 76 | 32 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1486 | 27 | 25 | 79 | 43 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1487 | 28 | 26 | 82 | 54 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1488 | 29 | 27 | 85 | 05 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1489 | 30 | 28 | 88 | 16 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1490 | 31 | 29 | 91 | 27 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1491 | 32 | 30 | 94 | 38 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1492 | 33 | 31 | 97 | 49 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1493 | 34 | 32 | 100 | 00 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1494 | 35 | 33 | 103 | 11 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1495 | 36 | 34 | 106 | 22 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1496 | 37 | 35 | 109 | 33 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1497 | 38 | 36 | 112 | 44 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1498 | 39 | 37 | 115 | 55 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1499 | 40 | 38 | 118 | 06 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1500 | 41 | 39 | 121 | 17 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1501 | 42 | 40 | 124 | 28 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1502 | 43 | 41 | 127 | 39 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1503 | 44 | 42 | 130 | 50 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1504 | 45 | 43 | 133 | 01 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1505 | 46 | 44 | 136 | 12 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1506 | 47 | 45 | 139 | 23 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1507 | 48 | 46 | 142 | 34 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1508 | 49 | 47 | 145 | 45 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1509 | 50 | 48 | 148 | 56 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1510 | 51 | 49 | 151 | 07 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1511 | 52 | 50 | 154 | 18 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1512 | 53 | 51 | 157 | 29 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1513 | 54 | 52 | 160 | 40 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1514 | 55 | 53 | 163 | 51 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1515 | 56 | 54 | 166 | 02 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1516 | 57 | 55 | 169 | 13 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1517 | 58 | 56 | 172 | 24 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1518 | 59 | 57 | 175 | 35 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1519 | 60 | 58 | 178 | 46 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1520 | 61 | 59 | 181 | 57 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1521 | 62 | 60 | 184 | 08 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1522 | 63 | 61 | 187 | 19 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1523 | 64 | 62 | 190 | 30 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1524 | 65 | 63 | 193 | 41 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1525 | 66 | 64 | 196 | 52 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1526 | 67 | 65 | 199 | 03 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1527 | 68 | 66 | 202 | 14 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1528 | 69 | 67 | 205 | 25 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1529 | 70 | 68 | 208 | 36 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1530 | 71 | 69 | 211 | 47 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1531 | 72 | 70 | 214 | 58 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1532 | 73 | 71 | 217 | 09 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1533 | 74 | 72 | 220 | 20 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1534 | 75 | 73 | 223 | 31 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1535 | 76 | 74 | 226 | 42 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1536 | 77 | 75 | 229 | 53 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1537 | 78 | 76 | 232 | 04 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1538 | 79 | 77 | 235 | 15 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1539 | 80 | 78 | 238 | 26 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1540 | 81 | 79 | 241 | 37 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1541 | 82 | 80 | 244 | 48 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1542 | 83 | 81 | 247 | 59 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1543 | 84 | 82 | 250 | 10 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1544 | 85 | 83 | 253 | 21 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1545 | 86 | 84 | 256 | 32 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1546 | 87 | 85 | 259 | 43 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1547 | 88 | 86 | 262 | 54 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1548 | 89 | 87 | 265 | 05 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1549 | 90 | 88 | 268 | 16 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1550 | 91 | 89 | 271 | 27 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1551 | 92 | 90 | 274 | 38 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1552 | 93 | 91 | 277 | 49 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1553 | 94 | 92 | 280 | 60 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1554 | 95 | 93 | 283 | 71 | 151 | 4 | 49 | 12 | 716 | 151 | 4 | 49 | 12 | 716 | 151 |
| 1555 | 96 | 94 | 286 | | | | | | | | | | | | |

A Table

OF THE PLACE OF THE SOUTHERN MAGNETIC POINT,
From within a Century of the time of the Creation (according to the Mosaic account)
until the year of our Lord 3877, including a period of 7800 Years, as it is found to
change its place, at the rate of $6^{\circ} 35' 40'' 32'''$ in a hundred Years, the Longitude
computed from the Meridian of Greenwich,

| Before Christ | East. | After Christ | West. | Before Christ | East. | After Christ | East. | After Christ | East. |
|------------------|-------|-----------------|-------|------------------|-------|-----------------|-------|-----------------|-------|
| o | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 3923 | 155 | 23 | 30 | 40 | 77 | 107 | 53 | 30 | 40 |
| 3823 | 140 | 17 | 50 | 08 | 177 | 114 | 20 | 11 | 12 |
| 3723 | 124 | 42 | 09 | 36 | 277 | 121 | 04 | 51 | 44 |
| 3623 | 130 | 06 | 29 | 04 | 377 | 127 | 40 | 32 | 16 |
| 3522 | 120 | 20 | 48 | 32 | 477 | 134 | 16 | 12 | 48 |
| 3423 | 122 | 55 | 08 | 00 | 577 | 140 | 51 | 53 | 2 |
| 3323 | 116 | 19 | 27 | 28 | 677 | 147 | 27 | 33 | 52 |
| 3223 | 109 | 42 | 46 | 56 | 777 | 154 | 03 | 14 | 24 |
| 3123 | 103 | 08 | 06 | 24 | 877 | 160 | 38 | 54 | 56 |
| 3023 | 96 | 32 | 25 | 52 | 977 | 167 | 14 | 35 | 28 |
| 2923 | 89 | 56 | 45 | 20 | 1077 | 173 | 50 | 16 | 00 |
| 2823 | 8 | 21 | 04 | 48 | 1177 | 179 | 34 | 03 | 28 |
| 2723 | 70 | 45 | 24 | 16 | East. | | | | |
| 2623 | 70 | 09 | 42 | 44 | 1277 | 172 | 58 | 22 | 46 |
| 2523 | 63 | 34 | 03 | 12 | 1377 | 166 | 22 | 42 | 14 |
| 2423 | 56 | 58 | 22 | 40 | 1477 | 159 | 47 | 01 | 42 |
| 2323 | 50 | 22 | 42 | 08 | West. | | | | |
| 2223 | 43 | 47 | 01 | 36 | 1523 | 153 | 50 | 45 | 24 |
| 2123 | 37 | 11 | 21 | 04 | 1572 | 153 | 21 | 08 | 23 |
| 2023 | 30 | 35 | 40 | 32 | 1577 | 153 | 11 | 21 | 22 |
| 1923 | 24 | 00 | 00 | 00 | 1582 | 152 | 51 | 34 | 21 |
| 1823 | 17 | 24 | 19 | 28 | 1587 | 152 | 31 | 47 | 20 |
| 1723 | 10 | 48 | 38 | 56 | 1592 | 152 | 12 | 00 | 19 |
| 1623 | 04 | 12 | 58 | 24 | 1597 | 151 | 52 | 13 | 18 |
| | | | | | 1602 | 151 | 32 | 26 | 17 |
| 1523 | 02 | 22 | 42 | 08 | 1607 | 151 | 12 | 39 | 16 |
| 1423 | 08 | 58 | 22 | 46 | 1612 | 150 | 52 | 52 | 15 |
| 1323 | 15 | 34 | 03 | 12 | 1617 | 150 | 33 | 05 | 14 |
| 1223 | 22 | 09 | 43 | 44 | 1622 | 150 | 13 | 18 | 13 |
| 1123 | 28 | 45 | 24 | 16 | 1627 | 149 | 53 | 00 | 00 |
| 1023 | 35 | 21 | 04 | 48 | 1632 | 149 | 33 | 43 | 20 |
| 923 | 41 | 56 | 45 | 20 | 1637 | 149 | 13 | 56 | 28 |
| 823 | 48 | 32 | 25 | 52 | 1642 | 148 | 54 | 09 | 27 |
| 723 | 55 | 08 | 06 | 24 | 1647 | 148 | 34 | 22 | 26 |
| 623 | 61 | 43 | 40 | 56 | 1652 | 148 | 14 | 35 | 25 |
| 523 | 68 | 19 | 27 | 28 | 1657 | 147 | 54 | 48 | 24 |
| 423 | 74 | 55 | 06 | 00 | 1662 | 147 | 35 | 01 | 23 |
| 323 | 81 | 31 | 48 | 32 | 1667 | 147 | 15 | 14 | 22 |
| 223 | 88 | 06 | 29 | 04 | 1672 | 146 | 55 | 27 | 21 |
| 123 | 94 | 42 | 09 | 36 | 1677 | 146 | 35 | 40 | 20 |
| 23 | 101 | 17 | 50 | 08 | | | | | |
| | | | | | 1682 | 146 | 15 | 53 | 19 |
| | | | | | 1687 | 145 | 55 | 06 | 18 |
| | | | | | 1692 | 145 | 36 | 09 | 17 |
| | | | | | 1697 | 145 | 16 | 32 | 16 |
| | | | | | 1702 | 144 | 56 | 45 | 15 |
| | | | | | 1707 | 144 | 36 | 58 | 14 |
| | | | | | 1712 | 144 | 17 | 11 | 13 |
| | | | | | 1717 | 143 | 57 | 24 | 12 |
| | | | | | 1722 | 143 | 37 | 37 | 11 |
| | | | | | 1727 | 143 | 17 | 50 | 10 |
| | | | | | 1732 | 142 | 58 | 03 | 09 |
| | | | | | 1737 | 142 | 38 | 16 | 08 |
| | | | | | 1742 | 142 | 18 | 29 | 07 |
| | | | | | 1747 | 141 | 58 | 42 | 06 |
| | | | | | 1752 | 141 | 38 | 55 | 05 |
| | | | | | 1757 | 141 | 19 | 08 | 04 |
| | | | | | 1762 | 140 | 59 | 21 | 03 |
| | | | | | 1767 | 140 | 39 | 34 | 02 |
| | | | | | 1772 | 140 | 19 | 47 | 01 |
| | | | | | 1777 | 140 | 00 | 00 | 00 |
| | | | | | 1782 | 139 | 40 | 12 | 59 |
| | | | | | 1787 | 139 | 20 | 25 | 58 |
| | | | | | 1792 | 139 | 00 | 38 | 57 |
| | | | | | 1797 | 138 | 40 | 51 | 56 |
| | | | | | 1802 | 138 | 20 | 04 | 55 |
| | | | | | 1807 | 138 | 01 | 17 | 54 |
| | | | | | 1812 | 137 | 41 | 30 | 53 |
| | | | | | 1817 | 137 | 21 | 43 | 52 |
| | | | | | 1822 | 137 | 01 | 56 | 51 |
| | | | | | 1827 | 136 | 42 | 09 | 50 |
| | | | | | 1832 | 136 | 22 | 22 | 49 |
| | | | | | 1837 | 136 | 02 | 35 | 48 |
| | | | | | 1842 | 135 | 42 | 48 | 47 |
| | | | | | 1847 | 135 | 23 | 01 | 46 |
| | | | | | 1852 | 135 | 03 | 14 | 45 |
| | | | | | 1857 | 134 | 43 | 27 | 44 |
| | | | | | 1862 | 134 | 23 | 40 | 43 |
| | | | | | 1867 | 134 | 03 | 53 | 42 |
| | | | | | 1872 | 133 | 44 | 06 | 41 |

N. B. The foregoing calculations for the Southern Magnetic point, are computed for the beginning of each Year.

A P P E N D I X.

Having received a considerable number of letters on the subject of the foregoing tract, from persons of eminence; for brevity's sake, only a few are inserted.



LETTER I.

From the American Minister and Plenipotentiary at the Court of France.

PARIS, AUGUST 8th, 1787.

SIR,

I HAVE duly received your favour of June 6th, and immediately communicated its contents to a member of the Academy.* He told me they had received the other copy of your memorial, which you mention to have sent through another channel; that your ideas were not conveyed so explicitly as to enable them to decide *finally* on their merit; but that they had made an entry on their Journals, to preserve to you the claim to the *original* idea. As far as we can conjecture it here, we imagine you make a table of variations of the needle, for all the different meridians whatever. To apply this table to use, in a voyage between America and Europe,—suppose the variation to increase a degree in every 60 miles,—two difficulties occur: 1st, a ready and accurate method of finding the variation of the place; 2d, an instrument, so perfect as that (though the degree on it shall represent 160 miles) it shall give the parts of the degree, so minutely as to answer the purposes of the navigator. The variation of the needle at Paris actually is 21° West. I make no doubt but you have provided against the doubts entertained here; and I shall be happy that our country may have the honour of furnishing the old world, what it has so long fought in vain. I am, with much respect,

Sir, your most obedient humble servant,

THOMAS JEFFERSON.

MR. JOHN CHURCHMAN, Philadelphia.

* *The Royal Academy of Sciences.*



LETTER II.

From Sir Joseph Banks, Bart. President of the Royal Society of London.

SOHO SQUARE, SEPT. 1st, 1787.

SIR,

I HAVE received your ingenious letter relative to the variation of the needle, and take the liberty of advising you to pursue, with diligence, a subject on which it appears to me you have made a progress, sufficient to authorize a reasonable hope, that science will derive real increase from your labours.

The Royal Society having lately removed into a new house, the first series of observations relative to the variation is only now in its course. I cannot therefore tell you with the utmost precision what the variation is there; our instrument at present gives $23^{\circ} 8'$ West, which probably is sufficiently exact for your purpose: presently, when the instrument is moved, we shall find if the magnetism of the building has any material effect upon it, of which, if it has, I shall with pleasure inform you I am, Sir,

Your obedient and most humble servant,

JOS: BANKS.

MR. JOHN CHURCHMAN.

LETTER III.

From the House of Delegates in Maryland, dated at Annapolis, in December, 1787.

SIR,

I AM commanded, by the Honourable House of Delegates. to return you their thanks, for your communication and explanation of your ideas, relative to the principles of magnetism, and their application in regulating the surveys of land; and I, with pleasure, return you the thanks of the House accordingly. I am, &c. &c.

THOMAS C. DEYE.

Speaker of the House of Delegates.

To JOHN CHURCHMAN, Esq.

LETTER IV.

From Sir H. Parker, Bart. Secretary to the Board of Longitude in Great-Britain

ADMIRALTY, 20th DEC. 1787.

SIR,

I HAD the honour, at the meeting of the Commissioners of Longitude, the 8th of this month, to lay before them the memorial you some time since transmitted to me, stating, that you have discovered certain fixed principles in magnetism, which will ascertain, to a great precision, the longitude of places in all parts of the globe, &c: and I am directed to acquaint you, the Board have the subject matter of your said memorial under consideration and will take an early opportunity of giving you their sentiments upon what you have submitted to them.

I am, Sir,

Your most humble servant,

H. PARKER, Sec'y to the
Commissioners of Longitude.

MR. JOHN CHURCHMAN,
Philadelphia.

LETTER V.

An extract of one, from Charles Blagden, M. D. Secretary to the Royal Society of London.

LONDON, JULY 6, 1789.

SIR,

I HAVE received your letter, with the enclosed address,* and presented the letter to the Royal Society, who desired their thanks to be returned for the same. It is contrary to the rules of the Society to read before them

* An address to the members of the different learned societies, shewing the deficiencies in professor Eulers memoir on this subject, see American Museum for May 1789.

printed papers, or such as are known to have been communicated to other learned bodies. The rumour of Sir Joseph Banks's death was without foundation: he is here in good health, and informs me, that your three letters[†] are in his possession.

+ Three letters on other subjects, duplicates of which were addressed to Comte de Cassini, Director of the Royal Observatory at Paris.

LETTER VI.

From the American Minister and Plenipotentiary at the Court of France.

PARIS, SEPT. 18th, 1789.

S I R,

I HAVE duly received your favour of the 15th of May. I had before received, and answered, the first letter you wrote me; but the second, which you mention to have written, never came to hand. I have sent to the Secretary of the Academy of Sciences the $\frac{1}{2}$ printed paper enclosed to your last. I asked at the same time the authenticated & copy, which you desired, of the entry on their Journals, relative to your former communications to them. This I now enclose to you, as I received it from the Marquis de Condorcet, their Secretary. Being about to leave this country, on a visit to my own, I shall be in hopes of perhaps meeting you some where in my tour; and of expressing to you, in person, my readiness, on all occasions, to be useful to you, in the business now in hand, and the sentiments of esteem with which I am, Sir,

Your most obedient humble servant,

THO. JEFFERSON.

MR. CHURCHMAN.

§ Copy of the entry on the Journals of the Royal Academy of Sciences above mentioned:

“ La lettre de M. Churchman, de Philadelphie, sur la variation de l'aiman,
“ à été lue à l'Académie des Sciences de Paris, le 16 Juin, 1787.

" Je certifiè cet extrait conforme aux registres de l'Académie à Paris,
" le 25 Septembre, 1780.

“ LE MARQUIS DE CONDORCET.”

LETTER VII.

From Nicholas Van Staphorst, Esq; of Holland.

Mr. JOHN CHURCHMAN, in Philadelphia,

AMSTERDAM, 22d OCTOBER, 1789.

SIR,

RECEIVED, in due time, your very esteemed favour of 17th April, with the printed address † mentioned therein, which I with great pleasure laid before my worthy friend, Professor Van Swinden, whose observa-

‡ An address to the members of the different learned societies, shewing the deficiencies in professor Euler's memoir on this subject, see American Museum for May 1789.

tions thereon you will have in the enclosed remarks from him, in French and English. The works he alludes to, I forward in a packet, by this conveyance, to Mr. George Mead, of your city, to be delivered to you; and sincerely wishing they may prove to your satisfaction. I am, with every disposition to render you the useful or agreeable offices in my power, very truly, Sir,

Your most obedient humble servant,

NICHOLAS VAN STAPHORST.

LETTER VIII.

Being an extract of one from J. H. Van Swinden, Professeur de Philosophie dans l'Université de Franeker, Associé étranger de la Société Royale de Médecine de Paris, Membre des Académies de Bruxelles & de Bavière; des Sociétés de Haarlem & d'Utrecht; Membre Consultant de la Société de Physique expérimentale de Rotterdam, & de la Société de Médecine de la Haye: Correspondant des Académies Royales de Paris & de Turin.

TO determine the longitude by observations on declination, is a great undertaking, and worthy of all our encomiums. Navigators are most interested in its good success. This success depends, I think, upon the complete solution of these two very interesting problems: first, to determine by theory what must be, at a given time, the declination of the magnetic needle, for every point of the globe, or for every place, whose longitude and latitude are given; secondly, in a place whose latitude is given, the declination at a certain time being known, to conclude its longitude by comparing the said observation with the theory.

The first problem consists of two parties, the one purely mathematical, the other physico-mathematical, because it is a question to draw from the observations, the chief data upon which the real calculations are to be founded.

The main part of observations made at sea are deficient, not only because they are perhaps ill made, but because they are ill calculated. I know certainly they commit a considerable error with respect to this on board of our East-Indiamen, of our merchantmen, and even on board of several of our men of war; namely: They take an observation of the sun at its rising or setting, the very moment its centre appears upon the horizon; then they compute its octave, or occult amplitude, whence they deduce the declination. But when the sun's centre seems to be in the horizon, he is really 33' under it: and so the arch contained between the needle and the apparent place of the centre, is not the arch contained between the needle and the true centre, and this is more or less to the east or west, than is supposed in the calculation. This error, that could be so easily corrected, may amount sometimes to two degrees, being one while addititious, another subtractive. By those means, the declination seamen put in their journals is always faulty, though their observation be right; I looked over a great quantity of journals, and I saw, what was a necessary consequence of what I said, that the declination by amplitude is always different from that by azimuth. And this, though any body might say it is of little consequence in practice, is, nevertheless, of great importance in theory, and for the laws that may be deduced from a series of observations of that kind.

Report of a Committee of Congress, which was published in the Journal.

In the House of Representatives of the United States,
Monday, 20th April, 1789.

MR. TUCKER reported, from the Committee to whom was referred the petitions of John Churchman and * David Ramsay,—that the Committee had, according to order, had the said petitions under their consideration, and agreed to report thereupon; which he delivered in at the Clerk's table, where the same was twice read, and debated by clauses, the first clause, in the words following,—to wit,

“ The Committee have conferred with Mr. Churchman, and find he has made many calculations, which tend to establish his position, that there are two magnetic points, which give direction to the needle. That, upon this doctrine, he has endeavoured to ascertain, from a given latitude, and a given variation, what must be the longitude of the place; and, having applied his principles to many instances in Cooke's Voyages, has found the result to correspond, with considerable accuracy, with the real facts, as far as they could be determined by the reckoning of the ship. That the object to which Mr. Churchman's labours are directed, is, confessedly, of very high importance; and his ideas on the subject appear to be ingenious. That, with a view of applying them to practice, he has contrived a map and a globe, whereby to shew the angles which are made by the intersection of the real and the magnetic meridians, in different parts of the earth. That he is also engaged in constructing tables, for determining the longitude at sea, upon magnetic principles. That the committee are of opinion, that such efforts deserve encouragement; and that a law should pass to secure to Mr. Churchman, for a term of years, the exclusive pecuniary emolument to be derived from the publication of these several inventions,”—was again read; and, on the question put thereupon, agreed to, by the House.

The second clause, in the words following,—to wit: “ With respect to the voyage proposed by Mr. Churchman, to Baffin's Bay, the Committee are cautious of recommending, in the present deranged state of our finances, a precipitate adoption of a measure, which would be attended with considerable expence: But they are of opinion, that, at a future day, if Mr. Churchman's principles should be found to succeed in practice, it would be proper to give farther encouragement to his ingenuity,”—was again read; and, on a motion made, ordered to lie on the table.

On motion, ordered.—That a bill or bills be brought in, making a general provision for securing to authors and inventors the exclusive right to their respective writings and discoveries; and that Mr. Huntington, Mr. Cadwallader, and Mr. Contee, do prepare and bring in the same.

Extract from the Journal.

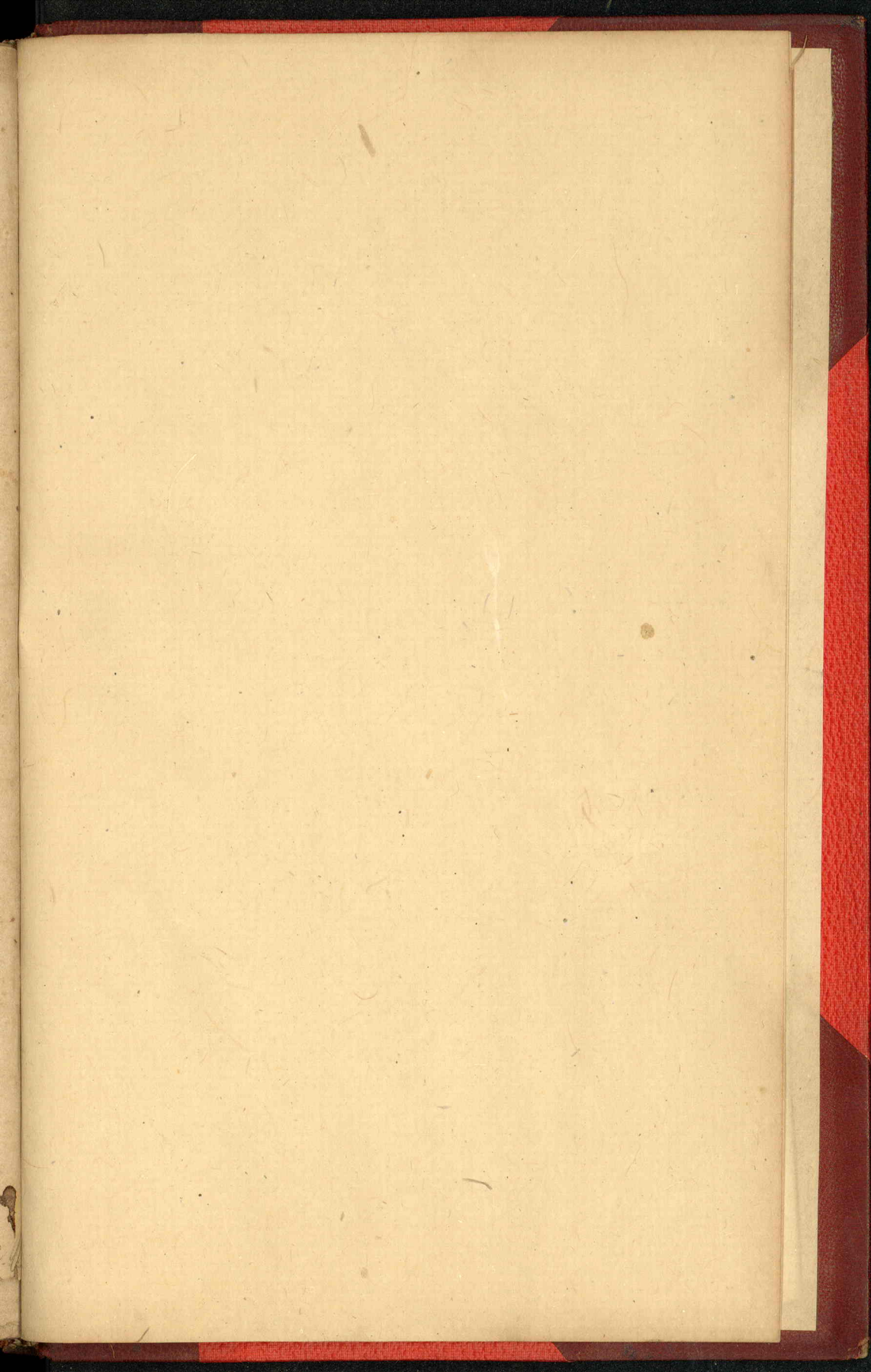
JOHN BECKLEY, CLERK.

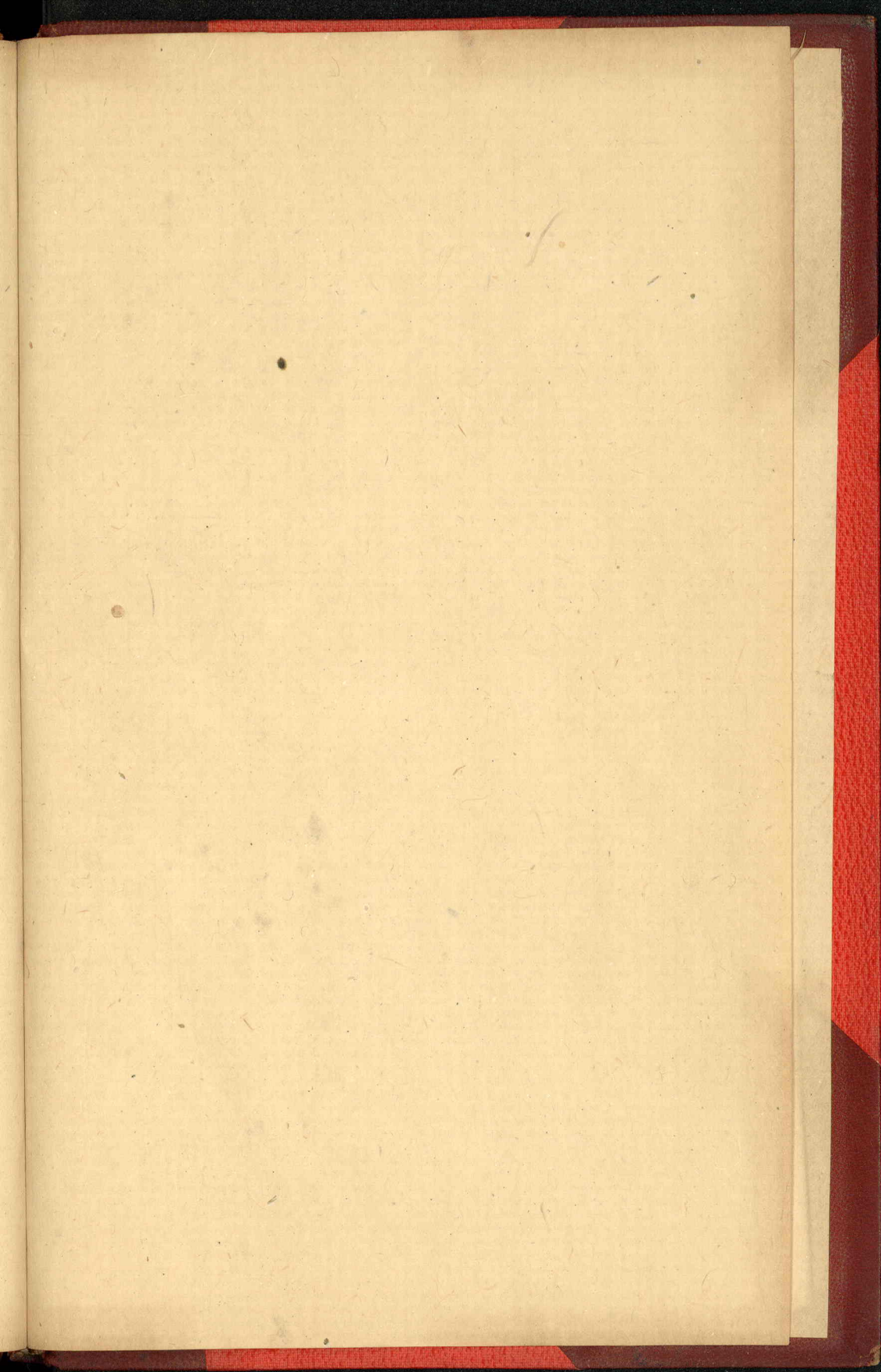
* Dr. Ramsay's petition was concerning his history of the revolution.

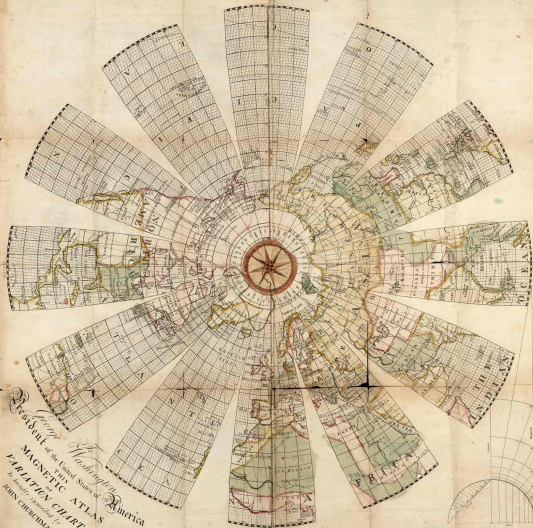
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M. A.







President
George Washington
 of the United States of America
 THIS
MAGNETIC ATLAS
 OR
VARIATION CHART
 is kindly presented to
 JOHN CHURCHMAN.

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